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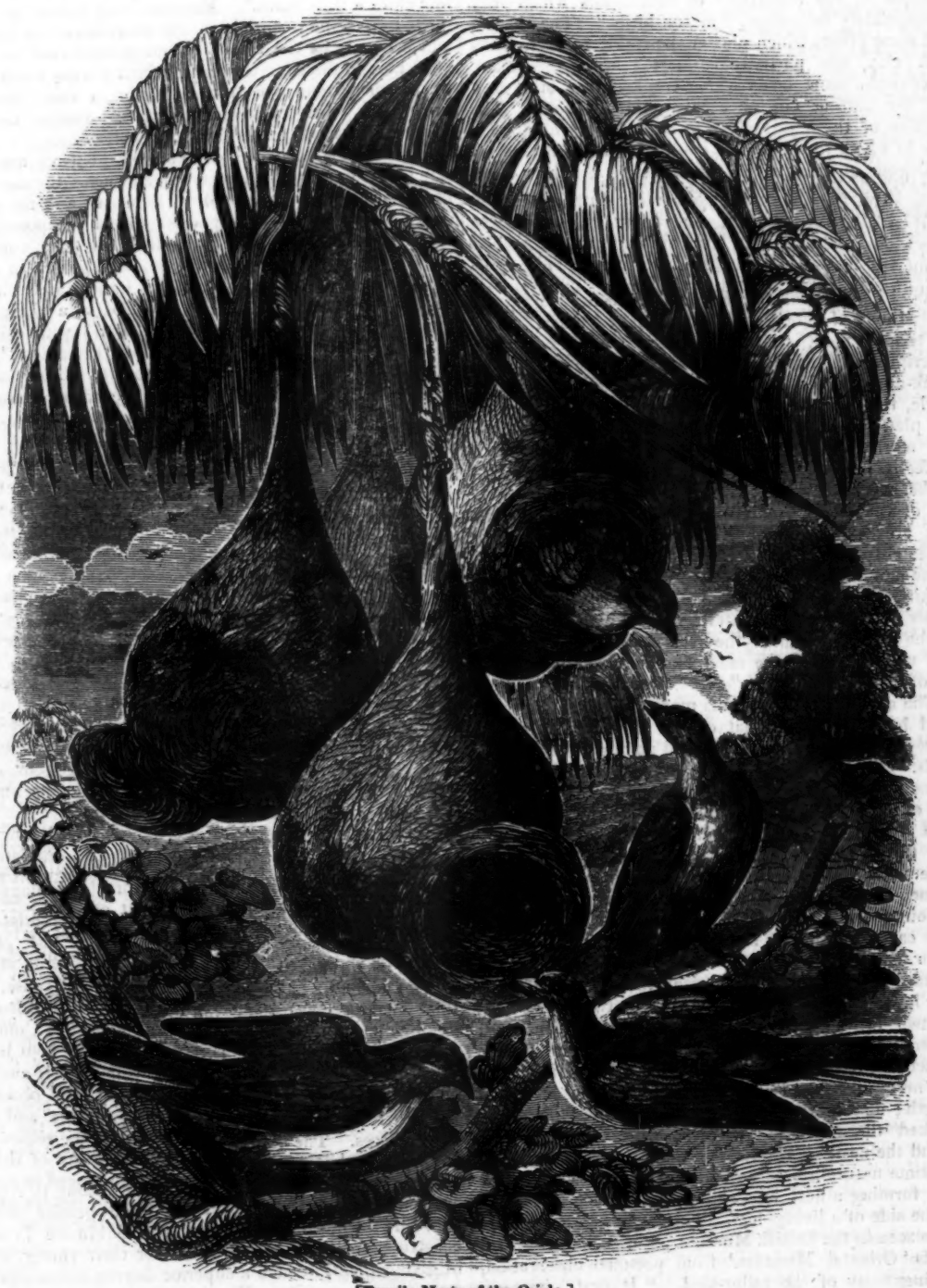
BIRDS' NESTS.



[Pensile Nests of the Oriole.]

In the volume entitled 'Architecture of Birds,' published by the Society, the subject is divided according to the various modes in which birds manifest their skill as builders. Not fewer than twelve divisions have thus been rendered necessary, each exhibiting architectural conceptions differing in some degree from one another.

The first division includes "mining-birds," such as the sand-martin, which scoops out its nest in the escarpment of a sand-pit or quarry: the burrowing-owl (described in the 'Penny Magazine' No. 93, vol. ii.), the bee-eater, and several others belong to this class. Next come the "ground-builders," which construct a rude nest on the surface, and select a spot possessing a temperature or moisture favourable to the process of incubation. The swallow furnishes the most striking example of the operations of individuals which may appropriately be termed "mason-birds." The thrush, and some others which plaster the inside of their nests with clay, are partially connected with this class. Afterwards come birds which employ their bills as a tool for cutting out or excavating their nests. The practice of the woodpeckers in boring and chiselling a hole in which to shelter the young brood, using means analogous to those which the carpenter employs, obviously suggests the idea of classing them, with some others of similar habits, as "carpenter-birds." Those birds, the natural heat of whose body is very great, and who seldom have more than a couple of eggs each sitting, take little trouble in the construction of their nests. They are of the simplest and rudest form, and consist only of a few sticks loosely laid together. They are termed "platform-builders," this term being really descriptive of their breeding-places. The ring-dove, stock-dove, and pigeons generally, with the golden eagle, the osprey, the heron, the stork and the crane are platform-builders. Among the ruins of Persepolis the stork frequently builds its nest on the top of a perfectly flat column. The birds whose nests resemble basket-work are a large class; and the materials made use of vary from dried twigs, which form the outwork and are without flexibility, to carpenter's shavings, delicate fibrous roots, grass both coarse and fine, and horse-hair. The degree of art with which the "basket-making birds" employ their materials is not less various. Other birds weave the materials of their nests together in the neatest manner: the nests of the hedge-sparrow and wagtail afford the most familiar examples of the art of the "weaver-birds."

The art of the tailor seems more unlikely to be practised by a bird than that of the weaver. There are, however, several varieties included amongst the "tailor-birds." The orchard-starling of the United States forms the external part of its nest of a particular species of long, tough, and flexible grass, "knit or sewed," says Wilson in his 'American Ornithology,' "through and through in a thousand directions, as if actually done with a needle." He relates that an old lady of his acquaintance, to whom he was once showing this curious fabrication, asked him, in a tone between joke and earnest, whether he did not think it possible to learn these birds to darn stockings? The nest of the orchard-starling is hemispherical, three inches deep by four in breadth; the concavity scarcely two inches deep by two in diameter. The enthusiastic ornithologist whom we have quoted says, "I had the curiosity to detach one of the fibres, or stalks, of dried grass from the nest, and found it to measure thirteen inches in length; and in that distance it was thirty-four times hooked through and returned, winding round and round the nest." The tailor-bird of India is described by some naturalists as actually picking up a dead leaf, and forming a nest by sewing it with some fine fibres to the side of a living leaf. Three nests so formed are to be seen in the British Museum. Forbes has described in his 'Oriental Memoirs,' from personal observation, the ingenuity of the tailor-bird. "It first," he says, "selects a plant with large leaves, and then gathers cotton from the shrub, spins it to a thread by means of its long bill and slender feet, and then, as with a needle, sews the leaves neatly together to conceal its nest."

The idea that man learned some of the useful arts from observation of the habits of other animate beings is not true in any extensive sense. Instinct pointed out to the class termed "felt-making birds" the suitability of the materials which they select for weaving or uniting into a continuous mass. The nest of the capocier, an American bird, which was examined by Wilson, is described by him as so "neatly worked and felted together, that it might have been taken for a piece of fine cloth a little worn." Man was long before he employed the same materials in the manufacture of cloth, and it is only by the aid of the microscope that he has been able to discover the cause which adapts them for this purpose, and the true character of their felting properties. The "felt-making birds" availed themselves of these properties from the creation.

The nests of the esculent swallow of Java are an article of commercial importance, the nests themselves being edible, and considered as a luxury and restorative. These nests are supposed to be composed of oceanic vegetables, whose principle being highly gelatinous, and cemented with the salivary gluten of the bird, form a sort of edible paste. Other birds whose nests are tempered by cement produced by a glutinous matter which the bird secretes and mixes with saliva, are, with the Java swallow, classed as "cementers."

The "dome-builders" include several of our most familiar birds—as the magpie, the wren, the sparrow. Lastly come birds which build no nest at all, but deposit their eggs in the nest of some other bird.

That birds are admirable and ingenious artificers cannot be doubted by any one who has attentively examined their workmanship; and as masons, carpenters, weavers, and even tailors, their talents obtain for them advantages similar to those which analogous arts procure for man. But a bird's nest—

> Mark it well, within, without!
> No tool had he that wrought; no knife to cut,
> No nail to fix, no bodkin to insert,
> No glue to join: his little beak was all:
> And yet how neatly finished! What nice hand,
> With every implement and means of art,
> Could compass such another?

The cut represents the pensile nests of the Oriole, a native of the United States of America. These birds have been pleasingly described by Wilson, in the 'American Ornithology.' We cannot do better than present the reader with the account given by this ardent ornithologist. We may premise that Alexander Wilson was a poor weaver of Paisley, who emigrated to the United States, and, compelled by an enthusiastic passion and desire to examine the form and manners of every bird which is an inhabitant or sojourner in that country, he taught himself, at the age of forty, to draw and colour after nature, and devoted himself to studies which might enable him to do justice to the subject which he had taken in hand. He travelled for this purpose more than ten thousand miles amid swamps and forests, "a solitary and exploring pilgrim," as he called himself, and though under very great discouragements, he succeeded in bringing out nine volumes in quarto, which are known to every scientific naturalist and intelligent lover of nature in the two hemispheres. The following is abridged from his account of the orioles:—

"Almost the whole genus of orioles belong to America, and, with a few exceptions, build pensile nests. Few of them, however, equal the Baltimore in the construction of these receptacles for their young, and in giving them, in such a superior degree, convenience, warmth, and security. For these purposes he generally fixes on the high bending extremities of the branches, fastening strong strings of hemp or flax round two forked twigs, corresponding to the intended width of the nest; with the same materials, mixed with quan-

tities of loose tow, he interweaves or fabricates a strong or firm kind of cloth, not unlike the substance of a hat in its raw state, forming it into a pouch of six or seven inches in depth, lining it substantially with various soft substances, well interwoven with the outward netting, and, lastly, finishes with a layer of horse-hair; the whole being shaded from the sun and rain by a natural pent-house or canopy of leaves.

"Though birds of the same species have, generally speaking, a common form of building, yet, contrary to the usually received opinion, they do not build exactly in the same manner. As much difference will be found in the style, neatness, and finishing of the nests of the Baltimores, as in their voices. Some appear far superior workmen to others: and probably age may improve them in this as it does in their colours. I have a number of their nests now before me, all completed, and with eggs. One of these, the neatest, is in the form of a cylinder, of five inches diameter, and seven inches in depth, rounded at bottom. The opening at top is narrowed, by a horizontal covering, to two inches and a half in diameter. The materials are flax, hemp, tow, hair, and wool, woven into a complete cloth; the whole tightly sewed through and through with long horse-hairs, several of which measure two feet in length. The bottom is composed of thick tufts of cow hair, sewed also with strong horse-hair. This nest was hung on the extremity of the horizontal branch of an apple-tree, fronting the south-east, was visible a hundred yards off, though shaded from the sun, and was the work of a very beautiful and perfect bird. The eggs are five, white slightly tinged with flesh colour, marked on the greater end with purple dots, and on the other parts with long hair-like lines, intersecting each other in a variety of directions.

"So solicitous is the Baltimore to procure proper materials for his nest, that, in the season of building, the women in the country are under the necessity of narrowly watching their thread that may chance to be out bleaching, and the farmer to secure his young grafts; as the Baltimore, finding the former, and the strings which tie the latter, so well adapted for his purpose, frequently carries off both; or, should the one be over heavy and the other too firmly tied, he will tug at them a considerable time before he gives up the attempt. Skeins of silk and hanks of thread have been often found, after the leaves were fallen, hanging round the Baltimore's nest. Before the introduction of Europeans, no such material could have been obtained here; but, with the sagacity of a good architect, he has improved this circumstance to his advantage."

The Baltimore bird, or Oriole, is known by a variety of names—such as hang-nest, hanging-bird, golden robin, fire-bird (from the bright orange seen through the green leaves, resembling a flash of fire), &c.; but is most generally called the Baltimore bird, from its colours, which are black and orange, being, says Catesby, those of the arms or livery of Lord Baltimore, formerly the proprietor of Maryland. These birds are several years in receiving their complete plumage. The Baltimore inhabits North America from Canada to Mexico, and is even found so far south as Brazil. Wilson says, "Since the streets of our cities have been planted with that beautiful and stately tree, the Lombardy poplar, these birds are our constant visiters during the early part of summer; and, amid the noise and tumult of coaches, drays, wheelbarrows, and the din of the multitude, they are heard chaunting 'their native wood-notes wild;' sometimes, too, within a few yards of an oysterman, who stands bellowing, with the lungs of a Stentor, under the shade of the same tree, so much will habit reconcile even birds to the roar of the city, and to sounds and noises that, in other circumstances, would put a whole grove of them to flight." The same agreeable writer describes the note of the Baltimore as "a clear mellow whistle, repeated at short intervals as he gleans among the branches. There is in it a certain wild plaintiveness and *naiveté* extremely interesting;" and he compares it to "the pleasing tranquillity of a careless ploughboy whistling merely for his own amusement."

The Orchard Oriole, another variety of this species of birds, often attaches its habitation to the long pendent branches of the weeping willow. The nest in this case is formed of the same materials as already described, but is of a slighter texture and much deeper. These branches, being sometimes twelve and even fifteen feet in length, have a large sweep in the wind; and hence the nest is made deeper to prevent the eggs or young from being thrown out.

DEFORMITIES OF THE CHEST.

(Abridged from an Essay by William Coulson, Esq., Consulting Surgeon to the London Lying-in Hospital, &c.)

THE deformities of the chest, owing to their universality, are of vast public interest, and afford an extensive field for pathological investigation; for by whatever cause the natural dimensions of that cavity become altered, whether from mechanical compression, deformities, disease of the spine, or other circumstances, the natural action of the organs contained within it must be more or less deranged, and the health of the individual ultimately affected.

The subject has always been one of great interest, and that interest has increased of late years, owing to the prevalent modes of dress—the pressure of stays, busks, &c., by which some of these deformities are caused or increased.

There are two kinds of deformities of the chest to which we shall more immediately direct attention. In the first, the sides of the chest are flattened, and the *sternum*, or breast-bone, is prominent; in the second, the sternum is depressed or concave in front, and the sides of the chest more convex than natural.

In most cases the subjects of the first kind of deformity are of a weak constitution, and sometimes, as Dupuytren observes, the offspring of unhealthy people, dwelling in low, damp, and cold places, ill clothed, and brought up on unsubstantial food.

The deformity exists sometimes from the birth; at others, however, it occurs during childhood, or later. Indeed, Dr. Copland says that his experience leads him to state that it generally comes on gradually after birth, owing to deficient inflation and development of the lungs, arising from the weakness of the muscles of inspiration, and the flexibility of the ribs at the time of birth; that in cases of this description the vital energy of the lungs is insufficient for their healthy action, and the respiratory mechanism unable to accomplish their full expansion, or sustain the continued pressure of the atmosphere; and that it has appeared to him very frequently to be greatly increased, if not altogether occasioned, subsequently to birth, by the very common practice, among nurses, of lifting the child by pressing the palms of the hand on the sides of the chest, immediately under the armpits. In these views Mr. Coulson is inclined to concur, though not disposed to lay great stress on the incidental cause just mentioned.

In this deformity the sides of the chest are very much flattened, one side being sometimes more depressed than the other; the ribs occasionally appear as if driven inward, or as if pressed from one side to the other; and in some children this compression exists to such an extent, that the two sides of the chest can be grasped with the fingers of one hand.

In consequence of this, the sternum projects, like the breast of a pigeon; whence persons with this deformity

are called pigeon-breasted. The sternum, however, is not always so prominent as it at first sight appears to be, the projection being formed by the sternal extremities of the ribs, and the sternum itself being either flat, or a little concave at its lower, and projecting at its upper part.

When it is considered how very unfavourable this contracted state of the chest is to the proper development and exercise of the organs contained within, it is but natural to expect that their function should be deranged. The extent of this derangement depends in a great measure on the extent of the deformity.

If no attempt be made to remedy the deformity at an age when the bones are in a pliant state, the patient, sooner or later, falls a sacrifice to some disease of the lungs, or heart, produced or excited by the constant functional derangement to which these organs have been subject.

The external appearances of the chest in the second kind of deformity are directly the reverse of those which we have been considering. The sternum is hollow or concave anteriorly, being pressed inwards, either at its middle, at its lower part, or along its whole extent; the sides of the chest are very prominent, and the ribs very much bent; the chest is broad, but depressed anteriorly; the shoulders are high; and the spine is either straight, or but little altered from its natural shape.

Internally, the lungs and heart are, of course, compressed anteriorly; their functions are correspondingly altered, and their structure ultimately suffers.

The constitutional symptoms which attend this kind of deformity are not so severe as those which attend the other. The circulation is hurried, the breathing is generally short and quick, and the patient is frequently subject to cough, or chronic catarrh.

Although, then, the constitutional symptoms be not so severe in this deformity, still it is of the highest importance to attend to the removal of it, as its existence predisposes the patient to pulmonary attacks.

Whatever may be the ultimate cause of these deformities, both local and constitutional means are expedient in the treatment of them.

The constitutional remedies for both deformities are the same. Nutritious diet, regulating the digestive function, and perhaps the artificial salt-water bath, or preferably sea-bathing—in short, we must make use of all means by which the system can be duly kept up.

The local remedies suggested in the Essay are, various exercises adapted to strengthen the muscles which extend from the arms and shoulders to the chest, &c. These, however, must be judiciously directed and employed.

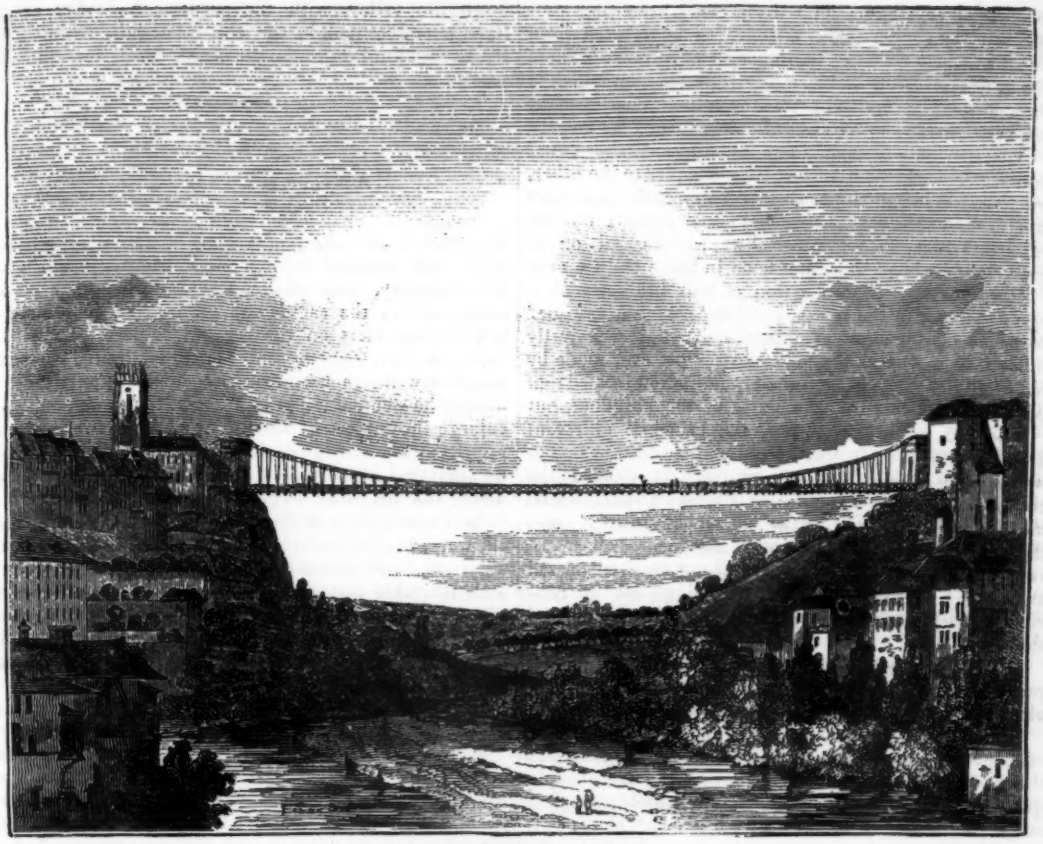
FRIBOURG SUSPENSION BRIDGE.

It is chiefly within the last thirty years that bridges have been constructed by suspending them on iron chains, or on rods linked together, so as to form a curve between two elevated extremities. A rope stretched across a river whose deep or rocky bed did not admit of a boat, and which could not be forded, has been the means of communication between the opposite banks in almost every mountainous country. And where materials sufficiently strong and durable could be procured to bear the weight of men and cattle, suspension bridges, on the same principle as those lately constructed, have been met with by travellers both in the Old and New World. In the interior of India and Thibet travellers have found iron suspension bridges, said to be of great antiquity, much resembling our own. In one place, the chains, which support a bridge of bamboo, are raised over stone piers, with openings in them for the road to pass through*. In another, the whole is constructed of twisted slips of bamboo, forming strong and durable cables, over which the road passes. Several such bridges are reported to exist in the mountainous part of Chinese Tartary.

In the magnificent mountains of South America there are bridges formed of strips of ox-hide, (a material which is readily procured in the plains from the immense herds of wild cattle which breed there,) or of the stems of creeping plants twisted into a rope. Sometimes a single rope forms the only means of traversing rivers. A basket suspended from a ring, or strong loop, through which the rope passes, is drawn along by means of smaller ropes, which reach to the opposite bank; and the traveller, seated in the basket, is ferried safely over torrents and ravines, which otherwise would be absolutely impassable. In other places a narrow board laid on ropes forms an unsteady bridge, which can only be ventured on by a practised mountain-traveller, whose head is accustomed to precipices, and whose feet can tread safely on an unstable support, which trembles under him.

But without going so far from our own shores, those who have explored the natural wonders of the north-west coast of Ireland, and the Giant's Causeway, will probably have seen the hanging bridge at Carric-a-rede, near Ballintoy, which is the simplest form of suspension bridges. It is formed by stretching two cables from the cliff to a rock which, at some time or other, has been separated from it by some convulsion of Nature. This rock stands like a pillar in the sea; and a chasm sixty feet wide, through which the sea rages furiously with the least swell of the waves, separates it from the rocky coast, from which it seems to have been torn. The cables are fixed to hooks firmly secured in the rock on one side, and on the other are kept properly stretched by means of a tackle and pulleys. The two cables are connected at intervals by ropes tied across them, which form a kind of ladder, like the shrouds in a ship. Boards are laid lengthways on these, and fastened down to form the bridge. These boards are not above eighteen inches wide; and there is no other protection than a rope stretched parallel to the bridge, at about three feet above one side of it, connected with the bridge at regular intervals, and forming a very insecure hand-rail. The length of the bridge is sixty feet, the height above the sea eighty. Over this swinging bridge the inhabitants—men, women, and children—pass and repass, as they would over a plank laid across a common ditch. Sheep are sometimes carried over it on men's backs, to eat the scanty herbage on the rock. The repairs of the bridge occasion considerable expense. It is removed every winter, and replaced in spring. The cables often require to be renewed; but the advantage to the fishermen is so great, that they never consider the cost. It has been in use longer than the present generation can remember. The same account of it was given to the writer of this in 1800, when he first visited it. This bridge may be considered as having existed before any of the modern suspension bridges in England, and may, amongst other circumstances, have contributed to give an idea of the extensive bridges erected since. The first bridge made in imitation of the Carric-a-rede bridge, as far as we know, was in the grounds of a lady in the county of Antrim, over a very picturesque waterfall in a rocky glen. The materials were rope, but they were formed into a much safer and more elegant bridge than the one at Carric-a-rede. The parapet was made of ropes, in the form of a strong net-work, and raised over high posts on each side, very similar to the piers now in use. It was in fact a very

* This bridge is called *chuka chasum*, and mentioned by Capt. Turner in his account of his travels in Thibet, 1783.



[Fribourg Suspension Bridge.]

good model of a suspension bridge, long before any more important structure of this kind was generally known.

In the United States of America several suspension bridges were constructed about forty years ago. One of these, over the Merrimack, at Newbury Point, has a span of 244 feet. About the same time a bridge suspended by wires was made over the Tweed, near Dryburgh Abbey, the seat of Lord Buchan, in Roxburghshire. The road on this bridge was supported by wires, stretched from different points of it to supports on each side. The span was 240 feet; but it was not made sufficiently strong to withstand the violent storms which occasionally sweep the course of the river; and it was destroyed in six months after its completion.

Some years after this, suspension bridges began again to occupy the attention of scientific men. Captain Brown of the Royal Navy first thought of using rods of iron, connected so as to form long flexible chains, instead of the iron chains with small links, which had come into use in the Navy, and which, from their strength and durability, seemed well adapted to form suspension bridges. He invented a strong and ingenious method of connecting the rods without diminishing their flexibility at the joints, for which he took out a patent.

He superintended the construction of several bridges; one of the first of these was the Union Bridge across the Tweed, five miles above Berwick. The span of this bridge is about 450 feet. It has stood well, and appears fully equal to support any weight which can fairly be brought upon it. It was completed in 1820.

He next built a pier at Newhaven, near Leith, to enable the passengers by steam-boats to land at all times of the tide. It projects 700 feet into the sea, and is formed in three spans. It is intended only for foot passengers, and consequently is of a light construction. The first pier on the land side is of strong masonry; the other three are frames of cast-iron, supported on piles driven into the sand. A platform at the end, sixty feet by fifty, rests on a strong frame-work of beams and piles; and is loaded to give the necessary support to the ends of the chains, where the great strain lies. It has answered the purpose well.

The elegant pier of Brighton is the work of the same engineer, and the plan of it is very similar. It consists of four bridges, or spans, each 255 feet long, and boldly projects into the sea at right angles to the cliff. The chains are secured on the land side by strong masonry. They pass over light pyramidal frames of cast iron, with a clear passage through them, which rest on piles well framed together, and they are fixed at the further end to a platform constructed like that at Newhaven, which forms a T with the bridge, being eighty feet across, and forty feet in the line of the bridge. A pavement of blocks of granite a foot thick and weighing altogether 200 tons, gives steadiness to this end. It was completed in a little more than a year, and is a great ornament to the town of Brighton. Its use for the landing of goods and passengers has not proved so great as was anticipated; and it suffered considerable damage in a storm on Oct. 15, 1833 (see 'Penny Magazine,' No. 105). But it is an agreeable promenade and much frequented. Although the original speculators are disappointed of their expected profit, it is a great advantage to the inhabitants, and the money collected at the entrance, from those who walk upon it for pleasure, is sufficient to keep it in repair.

The greatest undertaking of this kind was that of Mr. Telford, who planned a bridge across the straits of Menai, which separate the Island of Anglesea from the

coast of Caernarvon. This threw every preceding project into the shade. The distance to be crossed from shore to shore was nearly a quarter of a mile. There was a rock at some distance from one side, on which a pier might be erected; on the other side nothing appeared above the water. He determined to erect a pier at the same distance from the opposite shore, and to throw a suspension bridge from one pier to the other, the distance being 550 feet. He connected these piers with the shores next to them by stone arches; but the chains of the suspension bridge are carried on to each shore, where they are fixed in the rock in a very secure manner. A description of this bridge, with a cut, are given in the No. 167 of the 'Penny Magazine.' When this bridge was completed in 1826, it was justly considered as one of the boldest attempts ever made by any architect or civil engineer, and drew crowds of travellers, not only from all parts of the kingdom, but from many foreign countries, the principal object of whose journey was to view the Menai Bridge, as one of the modern wonders of the world. It divided the attention of the curious with the Thames Tunnel, which at one time was the great object of interest and curiosity all over the continent of Europe.

The Menai Bridge has, however, been much surpassed in distance between the piers, and lightness of construction, by the wire suspension bridge lately erected at Fribourg in Switzerland, of which we will now give a short but particular description.

This bridge has a span from pier to pier of 870 feet, and is suspended at the height of 167 feet above the river which flows under it. It is thus 319 feet longer than the Menai bridge, and 65 feet higher. Its great height and almost airy lightness, and the picturesque scenery around it, add greatly to the wonder which it excites in the beholder. To give a general idea of it, with the help of a very accurate representation in the annexed cut, we must first draw the attention of those who have never visited this highly interesting spot, to the situation of the city of Fribourg.

The small but rapid river, the Sarine, descends from the Fribourg Alps; and after winding along a very beautiful and romantic valley (in the midst of the mountains) to which it gives its name, and traversing the Gruyère country, it flows past the city of Fribourg, and falls into the Aar a little above Aarberg. It turns at a right angle round the base of the rock on which Fribourg is built. The ground here descends towards the river to the south of it, with a very steep slope, and is quite perpendicular on the north-east. The principal part of the town with the cathedral is built along the precipitous side, which rises from 200 to 300 feet above the bed of the river. The width of the valley on this side, at the height of 200 feet, is not above 300 yards; and here the bridge is suspended. The hill on the north-east side of the river rises to a considerable height.

Fribourg had always been an interesting object to travellers, but its situation and the great difficulty of the approach, frequently deterred the timid from visiting it. Since the bridge has been opened, the concourse is immense, and all those who have seen it will allow that, far from exaggerating, we cannot convey an adequate idea of the effect produced by the appearance of the bridge when seen in the morning or evening of a fine summer's day. If you stand in the valley at the place where the river forms a considerable angle, and look in a northern direction along the course of the stream, which is the view given in the cut, you have the magnificent Fribourg Alps behind you. On the left you look up the valley of the Sarine, towards the mountains situated at the bottom of the lake of Geneva, with the points of the higher alps overtopping them, clad with eternal snow. Before you is the view down the valley, with the suspension bridge across it, as is represented in the cut. The hills receding in the background towards the Jura, finish the splendid panorama.

[To be continued.]

ANCIENT BOOKS.

(*From the 'Pictorial Bible.'*)

In order to give the reader some idea of the probable form and material of this most ancient book, (see Deuteronomy, chap. xxxi. v. 24) and the other books mentioned in the sacred volume, we shall here state a few leading facts on the general subject. It will be observed that our present notice is limited to such portable writings as may more or less properly come under the denomination of "book." As we shall not enlarge the subject by investigating the chronological priority in the use of the different substances employed, we shall find it convenient to arrange our brief remarks under the heads of Vegetable, Metallic, and Animal Substances. Most of those we shall notice, or probably all, were, in due order of time, known to the Jews, as we either know positively from Scripture, or else may, with tolerable certainty, infer from their connections with other nations. It may be therefore more useful to view the subject connectedly, than to take it up in fragments, as the several passages bring the details under our notice.

I. Vegetable Substances.

1. *Wood.*—Inscriptions on wood are very ancient, but do not require to be here noticed. Tablets of wood were very early in use, and seem to have been generally employed much in the same way as slates among ourselves; that is, for temporary writing. Sometimes they were single, but frequently from two to five or more leaves were done up into a sort of book, something like our slate-books. The Greeks and Romans usually coated the boards with wax, on which the letters were traced with a *style*, or pen, commonly of iron, but also of gold, silver, brass, and sometimes ivory or bone. These instruments had one end pointed, to trace the letters, and the other broad and smooth, for the purpose of obliterating what had been written, by spreading back the wax, so as to render it fit to receive other words. In such books there was in the middle of each leaf a sort of button, to prevent the pages from touching each other when closed. But the greater warmth of their climate prevented the Jews from generally using wax: they therefore wrote on the tablets with a kind of ink, which could be easily sponged out when necessary. Such tablets of wood were in use long before the time of Homer, who lived 150 years before Isaiah; and Horne thinks it highly probable that several of the prophets wrote upon tablets of wood, or some similar material. (Compare Isa. xxx. 8, and Hab. ii. 2.) Such certainly was the "writing-table" on which Zecharias wrote the name of his son, John the Baptist. (Luke i. 63.) They were not wholly disused in Europe until the fourteenth century; and are still employed in North Africa, Western Asia, and Greece. The leaves of these tablet-books, whether of wood, metal, or ivory, were connected together by rings at the back, through which a rod was passed, that served as a handle to carry them by.

2. *Bark of trees.*—The fine inner bark of such trees as the lime, ash, maple, or elm, was early used as a substance for writing. As such was called in Latin *liber*, this name came permanently to be applied to all kinds of books, and has, in a similar connection, been adopted into most European languages. These books, like all others of flexible materials, were rolled up to

render them portable and to preserve the writing. They were usually rolled round a stick or cylinder; and if they were long, round two cylinders. Hence the name *volume* (volumen)—a thing rolled up—which continues to be applied to books very different from rolls. In using the roll, the reader unrolled it to the place he wanted, and rolled it up again when he had read it. The book of the law, written on parchment, is thus rolled and thus read in the Jewish synagogues at the present time. We do not know that rolls of bark are mentioned in the Scripture, but it does not therefore follow that they were not known to the Jews.

3. *Leaves of trees.*—Pliny thinks that the most early substance for writing was the leaf of the palm-tree; meaning, we presume, the first flexible substance. Be this as it may, the process is certainly of very remote antiquity; and would be naturally suggested by its being perceived how readily particular leaves received and retained marks made by a pointed instrument. At this day, books made with the leaves of different trees are common among the Indian nations, and specimens of them are numerous in England. The palmyra leaf is that which is most generally used; but others are preferred in some parts, as those of the talipot-tree, in Ceylon, on account of its superior breadth and thickness. The letters are written, or rather engraved, with a fine-pointed style, or sort of bodkin; and the writing is afterwards rubbed over with a composition of oil and pulverized charcoal, which renders the characters distinct and permanent.

4. *Papyrus.*—This was a vegetable tissue, the manufacture of which originated and was, in a great degree, peculiar to Egypt. It is obtained from a bulrush (*Cyperus papyrus*, Linn.) which grew in the swamps of the Nile to the height of ten or fifteen feet. The parts used in making the papyrus were the thin concentric coats or pellicles that surround the triangular stalk; those nearest the centre being the best and finest. A layer of these was laid out lengthwise on a board, and another layer pasted over it crosswise; and after being pressed and dried in the sun, the sheet was completed by the surface being polished with a shell, or other hard and smooth substance. A number of these sheets were glued together, to form a roll of the required dimensions. The breadth was determined by the length of the slips taken from the plant; but the length might of course be carried to almost any extent. The largest that has yet been found is thirty feet long. The writing, *as in all rolls of whatever material*, is not across the length or breadth of the roll, but in columns, extended in the direction of the roll's breadth, with a blank strip between them. Many such rolls have been found in Egypt, in mummy-cases and earthen vessels, and many also in the houses excavated at Herculaneum. The former, though more ancient, are better preserved and more easily unrolled than the latter, which have suffered from the action of heat. The superiority of the papyrus to all other materials previously known, brought it speedily into general use, for books, among the western civilized nations; and it must, in the time of the Apocrypha and New Testament, have been well known to the Jews. Indeed it may probably enough have been known to the prophets; for although the common account makes the discovery posterior to the foundation of Alexandria, this must be an error; since it was extensively used and formed an article of export from Egypt in the time of Herodotus, whose visit to that country was more than a century prior to the foundation of Alexandria. The rush itself is distinctly mentioned by Isaiah (xix. 7) in predicting the confusion of Egypt. Our wood-cut exhibits an Egyptian roll, and others at Herculaneum, in various illustrative circumstances—some unrolled, some closed, and others in the boxes in which they were usually kept, several together, deposited vertically, and ticketed at the upper extremity with their titles. (See more largely in 'Egyptian Antiquities,' vol. ii. chap. 7; and 'Pompeii,' vol. ii., chap. 13, in 'Library of Entertaining Knowledge.')

5. *Linen.*—The use of linen, as a substance for writing on, is allowed to have been long prior to the invention of papyrus. Indeed, it is evident that when men had invented linen cloth for dress, and afterwards began to feel the need of a flexible and durable material for writing, it would naturally occur to them, that, if their linen could be so prepared as to receive and retain the characters, it would be more convenient to form a portable book than any substance previously known. They soon found how to adapt their tissues to this purpose by priming or painting them all over, before they began to write, the writing itself being also rather painted than written, for the inks of antiquity were rather paints than inks, containing no mordant to give them durability; resembling, in this, the inks now used in the East. That such writing was known to the ancient Egyptians, we know from the written bandages which are sometimes found on mummies. Linen books are mentioned by Pliny and Vopiscus; and Livy speaks of such books that were found in the temple of Moneta. The obvious character of the resource is also indicated by the fact, that the pictorial epistles of the Mexicans were painted on a cotton tissue. The use of linen was certainly known to the Jews in the time of Moses, the priestly robes being principally of that material; and there are Biblical scholars who think that the original of the Pentateuch and the other books of the Old Testament were written on rolls of linen. The question is certainly open to investigation, as *rolls* only are mentioned in a general sense, without our being informed of what they were composed. Our own impression certainly is, that when a "roll" (מְגִלָּה, *megillah*) or "book" (סֵפֶר, *sepher*) is mentioned, we are to understand that it was either of linen, or of the skins of animals—sometimes, perhaps, the one, and sometimes the other.

II. Metallic Substances.

Tablets, and sometimes several tablets formed into a book, like the wooden tablets, consisting of plates of lead, copper, brass, and other metals, were anciently used, either to form leaves on which the wax might be spread, or else for the writing to be engraven upon them. The latter process is exceedingly ancient. Writing on lead is mentioned by Job (xix. 24). Pliny mentions that leaden sheets or plates were used for important public documents. This we learn also from other sources; and brass was also employed for inscriptions intended to be very durable. What Pliny says on the general subject is instructive. "At first men wrote on the leaves of the palm, and the bark of certain other trees; but afterwards public documents were preserved on leaden plates or sheets, and those of a private nature on wax and linen." The order of sequence here is of no weight; we cite it for the facts. Montfaucon purchased at Rome, in 1699, an ancient book entirely composed of lead. It was about four inches long and three inches wide; and not only were the two pieces that formed the cover, and the leaves, six in number, of lead, but also the stick inserted through the rings to hold the leaves together, as well as the hinges and nails. It contained Egyptian Gnostic figures and unintelligible writing. Brass, as more durable, was used for the inscriptions designed to last the longest, such as treaties, laws, and alliances. These public documents were, however, usually written on large tablets. The style, for writing on brass and other hard substances, was sometimes tipped with diamond (Jerem. xvii. 1).

III. Animal Substances.

1. *Skins.*—The skins of animals were in use for writing long before parchment was invented. Herodotus mentions the barbarians as writing or painting on the skins of goats and sheep; and Diodorus describes the ancient Persian records as being kept on the same substance. The recourse was so very obvious that it has prevailed in most countries. Even in America, the Mexicans had books of skins, and the North American Indians had maps painted on skins. It was also certainly one of the most ancient, if not the most ancient, form of portable writing; and they have great probability on their side who contend that the books of Moses were written on the skins of sheep or goats. The Jews, then, had most certainly the art of preparing and dyeing skins, for rams' skins dyed red, made a part of the covering for the tabernacle. In connection with this fact, the following particulars of a Hebrew MS. roll of the Pentateuch, now in the public library at Cambridge, are very instructive. The roll was discovered by Dr. Claudius Buchanan, in the record-chest of the black Jews in Malabar, supposed to be descended from the first dispersion of the Hebrew nation by Nebuchadnezzar. The date of the manuscript could not be ascertained, but the text is supposed to have been derived from those copies which their ancestors brought with them to India. It is written on a roll of goats' skins, *dyed red*, and measures forty-eight feet in length, by twenty-two inches in breadth. As it wants Leviticus and the greater part of Deuteronomy, it is calculated that its original length must have been not less than ninety English feet. In its present condition it consists of thirty-seven skins, comprehending 170 columns, four inches in breadth, and containing each from forty to fifty lines. It is in some places worn out, and the holes have been sewn up with pieces of parchment. (See further particulars in Horne's account of Hebrew Manuscripts in his 'Introduction,' vol. iv. p. 86—89.) We refer to this remarkable roll merely as representing a very primitive manner of writing important documents, without expressing any opinion as to the date of the roll or the value of its text. Dr. Buchanan himself states, in his 'Researches' (p. 236, ninth edit.), that "the Cabul Jews, who travel into the interior of China, say, that in some synagogues the law is still written on a roll of leather, made of goats' skins, dyed red; not on vellum, but on a soft flexible leather."

2. *Parchment.*—This is but an improvement, although a very important one, on the process just mentioned. It was one of the latest, if not the latest, of the various processes we have noticed; although some assign it a very early date, for want of adverting to the difference between it and *skins* less artificially prepared. The improvement is said to have been invented at Pergamos, at a time when Ptolemy Philadelphus prohibited the exportation of papyrus from Egypt, with the view of obstructing the formation of a grand library which Eumenes, king of Pergamos, was forming, and which he feared might eclipse his own great library at Alexandria. It is certain that the best parchment was made at Pergamos, and skins thus prepared were hence called *Charta Pergamena*, of which our *parchment* is a corruption. In Greek they are sometimes called *membrana* (μεμβρανα), under which name St. Paul mentions them in 1 Tim. iv. 13. Parchment came to be employed for legal, sacred, and other particular classes of works; but the comparative cheapness of papyrus, combined with as much durability as could be required for the more common literary works, maintained it still in general use. The Jews soon began to write their scriptures on parchment, of which the rolls of the law used in their synagogues are still composed.

3. *Ivory.*—Tablets and tablet-books of ivory, on the same principle as those of wood and metals, were anciently in use, much as they continue to be so among ourselves. They were written on with that paint-like ink which, as we have already noticed, might be washed off when necessary. The Burmese have beautiful books formed of ivory sheets, stained black, on which the characters are gilt or enamelled, and the margins adorned with gilding.

[Writing Materials and Implements.]

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